**Appendix C – Mitigation Measures**

To support Government's National Air Quality Plan to reduce levels of nitrogen dioxide ($NO_2$) National Highways has been working to achieve compliance with $NO_2$ limit values in the shortest timescales possible. This work has included evaluating a range of different measures to try and reduce $NO_2$ concentrations, so that the limit value can be met in the shortest timescales possible alongside the Strategic Road Network (SRN).

Since the publication of the previous assessments for Commission No. 3 in June 2021, there have been updates to the mitigation measures available to National Highways. These updates stem from new research, revisions to previously relied upon evidence, and changes to vehicle fleet rendering some earlier measures are now no longer viable.

National Highways has set a series of tests to ensure that any measures brought forward and implemented on the SRN are viable and effective. These tests are:

1. The proposed measure is underpinned by credible and robust evidence.
2. The measure can be delivered safely on a specific section of the SRN.
3. The measure would bring forward compliance by at least one calendar year earlier than without the measure.

Where a measure has been unable to demonstrate agreement with these tests, it is not considered a viable option for National Highways to achieve limit value compliance in the shortest timescales possible i.e. at least 1 year earlier when compared to without the proposed measure.

Table C1 summarises all measures assessed by National Highways as either viable or no longer viable.

**Table C1 List of Measures Assessed by National Highways**

| Measures | Summary | Evidence | Safety | Anticipated Improvement | Outcome |
|---|---|---|---|---|---|
| **Source** | | | | | |
| Local Traffic Management | Proposed traffic management measures cover a range of potential local interventions including traffic diversions, changes in signal timing at junctions or small-scale junction alterations. | The feasibility study would use traffic modelling or similar to investigate whether local scale interventions on the network could lead to reductions in traffic movements on the SRN on the basis of the proposed intervention.<br><br>Any proposed traffic intervention will be subject to detailed air quality modelling to assess the anticipated changes in $NO_2$ concentration. | Any intervention would be subject to a safety audit prior to the measure being approved.<br><br>National Highways has vast experience of safety delivering small scale traffic interventions on the SRN and local road network. | The potential change in $NO_2$ concentrations would need to be assessed on a case-by-case basis depending on the impact on local traffic brought about by the proposed measures. | Only those traffic management measures capable of making changes to traffic characteristics that would lead to a large enough reduction in $NO_2$ concentrations capable of bringing forward limit value compliance by at least one year earlier would be considered to be viable.<br><br>**Conclusion: This is a potential viable measure depending on local traffic conditions.** |
| 60mph Speed Limit | Initial research undertaken by National Highways, showed a potential reduction in tailpipe emissions when speeds are reduced from 70mph down to 60mph. The reduction in emissions in turn would lead to a reduction in roadside $NO_2$ concentrations. | The original basis for speed limits was based on vehicle emissions testing gathered in the UK and internationally at a range of different speeds and informed by driver behaviours. | The safety audits for the proposed locations of the 60mph speed limits for air quality concluded they were safe to be implemented. | Air quality modelling of the 60mph speed limit showed on average a 2µg/$m^3$ reduction in annual mean $NO_2$ concentrations. This level of change was assessed to bring compliance with the limit value at least one year earlier. | The analysis undertaken on the real world performance of the 60mph speed limit trial alongside the M1 and roadworks site on the M6 did not identify a clear change in measured $NO_2$ concentrations that could be attributed to |

| Measures | Summary | Evidence | Safety | Anticipated Improvement | Outcome |
|---|---|---|---|---|---|
| | | | | | changes in speed for either the 60mph speed limit trial or 50mph roadworks respectively.<br><br>There was no clear evidence that lowering speeds from the national speed limit (70mph on motorways) down to either 60mph or 50mph leads to a reduction in roadside $NO_2$ concentrations capable of bringing forward compliance with the annual mean $NO_2$ limit value by 1 or more years.<br><br>**Conclusion: This is not a viable measure.** |
| Electric Towns and Cities Initiative (ETCI) | A targeted intervention to provide grants to encourage regular users of a specific section of the SRN which is above the limit value to transition from a diesel van to an electric van. | Market research with a range of businesses helped to identify the level of funding required to support the conversion of a diesel van to an electric van. It was anticipated that circa 1,000 diesel vans on a specific route could | Converting from diesel van to an electric equivalent has no impact on safe use on the SRN. | The scheme proposed to replace approximately 1,000 vans over a 2-year period which would equate to approximately 3µg/m³ reduction in $NO_2$ concentrations. | The initial uptake of grants was much lower than predicted for a variety of reasons including cost of living challenges, change in government policy around stopping the sales of new petrol and |

| Measures | Summary | Evidence | Safety | Anticipated Improvement | Outcome |
|---|---|---|---|---|---|
| | | be converted to an electric van via the awarding of a grant. | | | diesel vehicles and stock availability of new vans.<br><br>This means that the ETCI scheme was unable to achieve its full potential meaning that the anticipated reduction in $NO_2$ would not be met and therefore compliance with the limit value would not be brought at least a year earlier.<br><br>**Conclusion: This is not a viable measure.** |
| Bus Retrofit | Installation of a retrofit system to the exhaust system. This means that the retrofitted bus should have lower emissions in line with Euro VI emissions standard. | Retrofitting buses would lead to lower emissions more in line with Euro VI emissions standard. Published emission factors for Euro VI buses and coaches showed lower emissions compared to earlier Euro Standards. On this basis, retrofitting would have resulted in lower emissions and subsequently lower | Retrofitting buses does not impact on their safe operation. | Modelling suggested even if National Highways had been able to convert the identified bus / coaches, due to the small number of vehicles affected this would have resulted in a reduction of much less than 1µg/m³ in $NO_2$. This meant this measure would not have helped achieve limit value any earlier. | This is not considered to be a viable measure as it would not bring forward compliance with the limit value by at least 1 year earlier.<br><br>Additionally, the government has been investigating the performance of retrofit systems as there have been concerns as to their effectiveness. |

| Measures | Summary | Evidence | Safety | Anticipated Improvement | Outcome |
|---|---|---|---|---|---|
| | | roadside $NO_2$ concentrations. | | | **Conclusion: This is not a viable measure.** |
| HGV Retrofit | Installation of a retrofit system to the exhaust system. This means that the retrofitted HGV should have lower emissions, more in keeping with the more modern Euro VI emissions standard. | Retrofitting HGVs would lead to lower emissions more in line with Euro VI emissions standard. Published emission factors for Euro VI HGVs showed lower emissions compared to earlier Euro Standards. On this basis, retrofitting would have resulted in lower emissions and subsequently lower roadside $NO_2$ concentrations. | Retrofitting HGVs does not impact on their safe operation. | Since the proposal of the measure in 2018, the vast majority of HGVs on the SRN now meet the latest Euro VI emissions standard and therefore would not benefit from retrofits. This means any reduction would have been less than 1µg/m³ in $NO_2$. This meant this measure would not have helped achieve limit value any earlier. | This is not considered to be a viable measure as it would not bring forward compliance with the limit value by at least 1 year earlier.<br><br>The vast majority of HGVs on the SRN already meet the Euro VI emissions standard.<br><br>**Conclusion: This is not a viable measure.** |
| **Pathway** | | | | | |
| Air quality barrier | A vertical barrier capable of reducing the difference between the monitored / modelled concentration for an identified section of the ARN and the required legal air quality threshold for annual mean nitrogen dioxide (40µg/$m^3$) to be achieved in the shortest timescales possible. | Air quality monitoring undertaken by National Highways indicates that barriers of different heights can achieve reductions of around 5µg/m³ in annual mean $NO_2$ concentrations in an area close to the barrier. And that taller barriers may offer reductions in $NO_2$ further back from the barrier. | Construction of a barrier would be in line with the relevant published safety standards and detailed designs. | The minimum level of change to be delivered by a vertical barrier shall be 5µg/$m^3$ $NO_2$ concentration at the location of the identified qualifying feature. | A reduction of 5ug/m3 would be capable of bringing forward compliance with the limit value by at least 1 year.<br><br>The opportunity to build a barrier would be considered on a location-by-location basis. |

| Measures | Summary | Evidence | Safety | Anticipated Improvement | Outcome |
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| | | | | | **Conclusion: This is a viable measure.** |
| Tunnels / Bypass | This is a measure that would either look to enclose a section of the SRN where there is an identified air quality exceedance in a tunnel or look at relocating the section of the SRN away from properties through the construction of a bypass. | Tunnels would effectively block the emissions from vehicles reaching the qualifying features and therefore, removing any exceedances.<br><br>The construction of a bypass would effectively relocate the source of emissions further from the properties and therefore, remove any exceedances as the emissions as diluted by the greater distance from the road. | Construction of a tunnel or bypass would be in line with the relevant published safety standards and detailed designs. | Tunnels would remove all road traffic pollution from the qualifying feature.<br><br>Construction of a bypass at a distance of greater than 15m from the qualifying feature would mean that this section of the network is no longer considered for limit value compliance. | Work undertaken considers the timelines to design, to take through the relevant planning approvals and build puts this measure around 10 years to complete. Given the latest timelines to achieve limit value compliance based on those links with the highest concentrations, it is unlikely that delivery of such measures could be realised before the limit value would naturally be achieved based on fleet renewals.<br><br>**Conclusion: This is not a viable measure.** |
| Low Friction Road Surfacing | Consideration has been given to whether new low friction road surfaces could help to lower vehicle emissions. The theory indicates that less energy is required to maintain vehicle speeds due to the reduced | Highways England (now National Highways) undertook research looking into the difference in measured exhaust emissions for a range of vehicles driven | The low friction road surface had been deployed on a small section of the SRN where this testing was undertaken. | The anticipated improvement was unknown, hence the need for emissions testing of a range of vehicles to examine whether there was any | The outcomes of the research concluded there was no statistically significant difference in measured NOx emissions between the two road surfaces. |

| Measures | Summary | Evidence | Safety | Anticipated Improvement | Outcome |
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| | lower friction road surface, which in turn would lead to a reduction in exhaust emissions. | on a section of road with the low friction road surface and hot rolled asphalt. | | change in emissions due to this road surface. | **Conclusion: This is not a viable measure.** |
| **Receptor** | | | | | |
| Footpath closures | This measure considers whether it is possible to close the footpath or cycle path and divert users on to an alternative route and away from the air pollution. | The closure of the footpath would effectively remove the qualifying feature from alongside the PCM link. | The closure of the footpath would be undertaken in accordance with the safety audits and design standards, ensuring alternative safe pedestrian routes are available. | There would no longer be any exceedance of the limit value as there would be no qualifying feature within 15m of the SRN PCM link. | Closing the footpath would remove the qualifying feature. PCM links with no qualifying features within 15m are considered to be compliant with the limit value because there is no public access.<br><br>**Conclusion: This is a viable measure.** |
| **Complementary Measures** | | | | | |
| Local Authority Clean Air Zone (CAZ) | Whilst not a measure delivered by National Highways, a local authority CAZ can support improvements on the SRN, where the CAZ encourages the upgrade of the vehicle fleet to newer and cleaner vehicles. | Any improvement on the SRN would be location specific and dependant on the impacts of the local authority CAZ as set out in their Air Quality Assessment Report. | Implementation of the CAZ would be subject to the relevant safety protocols enacted by the local authority, including any impacts or changes to traffic on the SRN. | Any improvement on the SRN would be location specific and dependant on the impacts of the local authority CAZ as set out in their Air Quality Assessment Report. | Not Applicable as measure enacted by local authority and does not require delivery by National Highways. |
| Road Scheme | A local road scheme promoted by National Highways or local planning authority. This is not a measure delivered for the purposes of limit value compliance but could help | Any improvement on the SRN would be location specific and dependant on the impacts of the promoted scheme as set | Implementation of the scheme would be subject to the relevant safety protocols enacted by the promoter, including any impacts or | Any improvement on the SRN would be location specific and dependant on the impacts of the promoted scheme as set | Not Applicable as changes in road traffic are related to the delivery of the scheme. |

| Measures | Summary | Evidence | Safety | Anticipated Improvement | Outcome |
|---|---|---|---|---|---|
| | achieve compliance through changes to the traffic on the SRN and local road network. | out in their Air Quality Assessment Report. | changes to traffic on the SRN. | out in their Air Quality Assessment Report. | |
| Electric Vans | A complementary scheme working in partnership with local authorities to offer local businesses the opportunity to try an electric van. The purpose was to show to businesses that an electric van could be a viable option and to encourage them to start the transition from diesel to electric vans. | Research completed for Highways England (now National Highways) in 2017 indicated, at that time, it would only be possible to bring forward a maximum of 250 electric vans over the next few years in any one location. | Converting from diesel van to an electric equivalent has no impact on safe use on the SRN. | On the basis of a small number of vans and not targeted on specific routes meant that any changes in $NO_2$ concentrations would be very small, i.e. less than 1µg/$m^3$. | At the time the measure was originally developed in 2018 there were few electric vans available and there was no means to provide grants to companies at that time.<br><br>The scheme was also unable to target specific routes.<br><br>**Conclusion: This is not a viable measure.** |